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Shuming Nie

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EXAMINER

LUM, LEON YUN BON

ART UNIT

PAPER NUMBER

1641

NOTIFICATION DATE

DELIVERY MODE

10/29/2009

ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No. 10/555,729	Applicant(s) NIE ET AL.	
	Examiner Leon Y. Lum	Art Unit 1641	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 October 2009.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 198,199,203-207 and 210-224 is/are pending in the application.
- 4a) Of the above claim(s) 216 and 217 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 198,199,203-207,210-215 and 218-224 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>7/23/09</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on September 22, 2009 has been entered.

Status of Claims

Claims 198 and 203 have been amended. Claims 1-197, 200-202, 208-209 are canceled. Claims 216-217 are withdraw. Claim 224 has been added. Accordingly, claims 198-199, 203-207, 210-215 and 218-224 are examined on the merits.

Claim Objections

Claim 212 is objected to because of the following informalities: the claim is dependent on a canceled claim. For examination purposes, claim 212 is considered to be dependent on independent claim 206. Appropriate correction is required.

Claim Rejections - 35 USC § 103

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The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

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Claims 198-199, 203-207, 210-215, 218, 220-221 and 223-224 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. to 6,710,366 to Lee *et al.* ("Lee") in view of U.S. Patent No. 6,207,392 to Weiss *et al.* ("Weiss").

i. Independent claims 198, 206 are obvious

Lee describes a quantum dot with a continuous graded alloy of distinct core and shell materials in an "interface region" between the core and shell. See column 7, lines 17-36. In this embodiment, the center of the quantum dot is purely core material and the outer surface of the quantum dot is purely shell material, with a continuous transition of the materials in the interface region, in which the transition is an alloy of the core and shell materials. *Id.* The core and shell materials can each comprise Group IV, Group II-VI or Group IV-VI semiconductor materials, including CdSe and CdTe. See column 13, lines 18-31 and lines 40-51. The alloy in the transition region would therefore be CdSeTe.

Further regarding claim 206, Lee teaches a population of monodispersed quantum dots with a deviation of less than 5% root-mean-square. See column 8, lines 32-35.

Lee, however, does not teach the specific ratios of semiconductor materials claimed – i.e., $\text{CdSe}_{1-x}\text{Te}_x$.

Weiss indicates that altering the concentration of an alloy in a nanocrystal can affect the emission wavelength of the alloyed semiconductor nanocrystal. See column 8, line 50 to column 9, line 11.

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With the foregoing description in mind, one of ordinary skill in the art would have found it obvious to optimize the specific ratios of the cited semiconductor alloy in the quantum dot since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 f.2d 272 (CCPA 1980). Here, the general conditions of the claim are taught in the prior – i.e., the CdSeTe alloy is described by Lee. *See supra*, rejection of 198. The missing limitation is the particular ratio between Se and Te as described above. However, because Weiss indicates that tuning an alloy concentration would affect emission wavelength, the alloy concentration is a result-effective variable that can be optimized. Accordingly, in light of the *Boesch* case, the skilled artisan would have found it obvious to optimize the ratio of semiconductor material in CdSeTe in order to affect the emission wavelength of the quantum dot. Moreover, tuning the emission wavelength would be appropriate for Lee's quantum dot because the quantum dot is used for optical purposes. *See e.g.*, column 52, lines 42-45. The skilled artisan would have had a reasonable expectation of success in combining the teachings of Lee and Weiss because both references describe the same type of semiconductor materials for producing a quantum dot. *See Weiss*, column 7, lines 35-49.

Furthermore, Applicants have admitted that the claimed subject matter is prior art. *See Specification*, page 10, paragraph 0044, reciting “[s]uch semiconductors are known in the art, including for instance, $\text{CdS}_{1-x}\text{Se}_x$...wherein x is any fraction between 0 and 1.” This type of admission can be relied upon in an obviousness rejection.

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Riverwood Int'l Corp. v. R.A. Jones & Co., 324 F.3d 1346, 1354 (Fed. Cir. 2003); see also MPEP 2129. Accordingly, by Applicants' admission, the instant claim is obvious.

ii. Dependent claims 199 and 207 are obvious

Lee teaches that the yield of the quantum dot can be between 35% and 95%.

See column 42, lines 14-17.

iii. Dependent claims, 203 and 224 are obvious

Lee teaches a CdSeTe alloy in the transition region, as described above. See *supra* rejection of claim 198.

iv. Dependent claims 204, 210 and 212 are obvious

Lee does not teach a biological agent conjugated to the quantum dot.

Weiss, however, describes nanocrystals bound to different affinity molecules to detect biological substances. See column 9, lines 14-35; column 12, lines 7-44.

With the foregoing description in mind, one of ordinary skill in the art would have found it obvious to modify Lee's quantum dots to conjugate a biological molecule thereon. The skilled artisan would have made the modification because doing so would allow the quantum dots to be used in a biological assay to detect a biological analyte. Moreover, because Lee indicates that ligands can be attached to the surface of the quantum dot, see Figures 1C and 1D, the skilled artisan would have had a reasonable expectation of success in conjugating Weiss's biological molecules onto Lee's quantum dots.

v. Dependent claims 205, 213 are obvious

Lee does not teach a quantum dot encapsulated within a polymer bead.

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Weiss, however, describes a semiconductor nanocrystal placed in a polymer sphere. See column 13, line 51. This configuration helps to provide a stable probe material for biological applications. See column 2, lines 6-17.

With the foregoing description, one of ordinary skill in the art would have found it obvious to modify Lee's teaching to encapsulate the quantum dot within a polymer sphere. The skilled artisan would have been motivated to perform the modification based on Weiss's description that this arrangement is helpful for producing a stable probe structure. Moreover, the skilled artisan has a reasonable expectation of success in combining the two references. See *supra* rejection of claims 198 and 206.

vi. Dependent claim 211 is obvious

Lee does not teach that the gradients vary amongst the population of quantum dots.

Weiss, however, teaches that the emission wavelength of an alloyed semiconductor nanocrystal can be tailored by adjusting the concentration of the alloys. See column 8, line 50 to column 9, line 11. Adjusting the alloy concentration in this manner can benefit applications that require a set of nanoparticles having different emission wavelengths, but a uniform size. *Id.* For example, having an array of nanocrystals with different emissions allows a user to perform a multiplex assay, in which different nanocrystals are bound to different affinity molecules to detect multiple biological substances. See column 9, lines 14-35 and column 12, lines 7-44.

With the foregoing description in mind, one of ordinary skill in the art would have found it obvious to modify Lee's population of monodispersed quantum dots by

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adjusting the alloy concentrations to provide different gradients between quantum dots, as taught by Weiss. The skilled artisan would have been motivated to perform this modification based on Weiss's teaching that doing so would allow one to perform a multiplex assay to simultaneously detect different biological substances. Moreover, the skilled artisan has a reasonable expectation of success in combining the two references. *See supra* rejection of claims 198 and 206.

vii. Dependent claims 214 and 215 are obvious

Weiss teaches a method of detecting an analyte by contacting a sample with a plurality of semiconductor quantum dots and detecting emitted light from the quantum dots. See column 13, lines 23-40.

Because Weiss provides a specific application of Lee's quantum dots, one of ordinary skill in the art would have found this application as motivation to combine the two references. Moreover, as discussed in the rejection of claim 204 above, the skilled artisan would have had a reasonable expectation of success in making the combination.

viii. Dependent claims 218, 220-221 and 223 are obvious

The only claimed element in claims 218 and 220-221 is the quantum dot already recited in base claims 198 or 206. Accordingly, because Lee and Weiss teach claims 198 and 206, they also teach claims 218 and 220-221.

Regarding claim 223, it recites an intended use of the quantum dot. But because the claim does not recite any structural limitations, it does not lay claim to a quantum dot that is distinct from the quantum dot in the base claim. Accordingly, because Lee and Weiss teach the base claim, they also teach claim 223.

Claims 219 and 222 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee in view of Weiss as applied to claims 198 and 218 (or claims 206 and 221) above, and further in view of U.S. Patent No. 6,846,565 to Korgel *et al.* ("Korgel").

Lee and Weiss, described above, do not teach an alloyed quantum in a light emitting diode.

Korgel describes semiconductor nanoparticles capable of being implemented in light emitting diodes. See column 1, lines 37-47 and column 2, lines 44-59.

With the foregoing description in mind, one of ordinary skill in the art would have found it obvious to modify Lee and Weiss's quantum dots by placing them in a light emitting device. The skilled artisan would have a reason for performing this modification since Lee teaches that the quantum dots are applicable in any optical-electrical device (see column 1, lines 31-33) and an LED is one type of optical-electrical device. Moreover, Korgel teaches that applicable nanoparticles include those having the same semiconductor materials as Lee's quantum dots. See column 1, lines 45-47. Accordingly, the skilled artisan would have a reasonable expectation of success in placing Lee and Weiss's quantum dots in an LED.

Response to Arguments

Applicants traverse the rejection of the pending claims in the response filed September 22, 2009. Applicants also filed a supplemental response and a Rule 132 Declaration on October 1, 2009. All arguments and the declaration have been

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considered. However, for the reasons below, Applicants' arguments and the declaration are not sufficient to overcome the current rejections.

i. Arguments against the anticipation rejection

Applicants traverse the rejection of claims 198, 199, 203, 218 and 220 as being anticipated by the Lee patent. See Response filed on September 22, 2009, pages 8-9 (focusing on independent claim 198). Because Applicants have amended claim 198 to recite a specific ratio of semiconductor alloy materials formerly recited under dependent claim 202 (now canceled), the anticipation rejection no longer applies. Instead, claim 198 is now rejected under the Lee and Weiss references, which were applied against claim 202 in the previous Office Action. As noted above, Weiss provides a reason for optimizing Lee's CdSeTe alloy to arrive at the claimed alloy ratio. See *supra* rejection of claim 198.

ii. Arguments against the obviousness rejection

Applicants further traverse the rejection of claims 202, 204-207, 210-215, 219 and 221-223 over the Lee and Weiss references. See Response filed on September 22, 2009, pages 9-11. Here, Applicants opine that the Lee reference does not provide an enabling description for making the quantum dot mentioned therein. See page 10, first and third paragraphs. Applicants focus on the absent of specific examples in the Lee reference. *Id.* Applicants also claim that one of ordinary skill in the art at the time of the Lee reference would not have known how to make such a quantum dot. *Id.* For discussion purposes, focus will be placed on independent claims 198 and 206 since it

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appears that the foregoing arguments are made solely against the Lee patent's applicability in teaching the concentration gradient limitation recited in these claims.

When a reference relied on expressly anticipates or makes obvious all elements of the claimed invention, the reference is presumed to be operable. See MPEP § 2121. Here, although independent claims 198 and 206 are rejected under a combination of the Lee and Weiss references, the focus of Applicants' arguments are on the Lee patent alone teaching the concentration gradient quantum dot. Accordingly, based on the principle just described, the Lee patent is presumed to be operable. Applicants therefore have the burden of rebutting this presumption by a preponderance of the evidence. *In re Sasse*, 629 F.2d 675, 207 USPQ 107 (CCPA 1980); see also MPEP § 716.07. For the reasons below, this presumption has not been adequately rebutted.

Where the affidavit or declaration presented asserts that the reference relied upon is inoperative, the claims represented by the applicant must distinguish from the alleged inoperative reference disclosure. *In re Crosby*, 175 F.2d 198, 71 USPQ 73 (CCPA 1946); see also MPEP § 716.07. In the *Crosby* case, claims directed to a stapling machine were held to be anticipated by a reference describing the same. Although the appellant had argued that the reference was not enabling, the Court noted that "[s]ince the patent device discloses each of the elements of claims 128 and 129, the decision of the board with respect to those two claims [upholding the examiner's rejection] is affirmed." *Id.* at 75. Here, Applicants do not argue that the Lee patent fails to teach the particular concentration-gradient limitation of the instant claims. Indeed, Applicants merely argue that Lee does not teach the particular ratios claimed, but do not

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argue that the particular concentration-gradient limitation is not taught by Lee.

Accordingly, in line with the *Crosby* case, Applicants' arguments are not convincing.

Moreover, the Federal Circuit has indicated that a lack of diagrams, flow charts, and other details in the prior art references did not render them nonenabling in view of the fact that applicant's own specification failed to provide such detailed information. *In re Epstein*, 32 F.3d 1559, 31 USPQ2d 1817 (Fed. Cir. 1994). In the *Epstein* case, the Appellant asserted that prior art references applied against the claims at issue are non-enabling. *Id.* at 1568. The Federal Circuit, relying on the BPAI, held that since the Appellant's own specification did not provide the level of detail "he now argues is necessary in prior art references" and there was no enablement rejection against the claims, this is evidence that the skilled artisan would have known how to implement the teachings of the prior art references. *Id.* Here, Applicants argue that the Lee reference is non-enabling because it only provides generalized disclosure without direction or guidance. See e.g., Response filed September 22, 2009, page 10, last paragraph. However, Applicants' own specification does not provide much more guidance than what is described by Lee. The most detail provided by the specification on how to make a concentration-gradient quantum dot is one paragraph (paragraph 143) on page 35, directed specifically to a mixture of Cd, Te and Se semiconductor materials. The rest of the specification describes concentration-gradient quantum dots in very generalized terms not unlike the Lee reference. The claims, however, are far broader than the CdTeSe quantum dot of paragraph 143. Indeed, they are directed to numerous semiconductor materials and combinations. Accordingly, following the logic of the

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Epstein case, if Applicants' own specification is enabling for a genus of concentration-gradient quantum dots, then the Lee patent, having a similar disclosure, is likewise enabling.

Applicants cite the *Hoeksema* case to support their argument. See Response filed September 22, 2009, page 10, third paragraph. The *Hoeksema* case stands for the proposition that a reference reciting a compound with unknown methods of production does not teach a claim to the compound. However, Applicants have not provided convincing evidence that, at the time of the Lee patent, there was no process for making concentration gradient quantum dots. Moreover, as described in the foregoing paragraph, except for CdSeTe quantum dots, the Lee patent and Applicants' disclosure are similarly vague in their descriptions on how to create quantum dots with concentration gradients. Accordingly, if Applicants' own disclosure is enabling for producing the claimed quantum dots, then the Lee patent similarly provides a known method for producing the same.

iii. The Rule 132 Declaration is insufficient to overcome the Lee reference

To support the foregoing arguments, Applicants filed a Rule 132 Declaration by a co-inventor of the instant application. The declaration asserts the same arguments presented in the response – i.e., the Lee patent allegedly provides no insight on how to make a gradient quantum dot, and that one of ordinary skill in the art at the time of the Lee patent would not have known how to make the quantum dot described by Lee. See page 2, items 4 and 5. However, for the reasons below, the declaration is insufficient to overcome the Lee reference.

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The Rule 132 Declaration presents one facet in the pool of evidence for and against Lee as an enabling reference. Although it comes from a very distinguished authority in the art, the declaration provides insufficient evidence to overcome the presumption that the Lee reference is enabling. The declaration merely states without providing reasons why one of ordinary skill in the art would not have been able to create the quantum dot based on Lee's. A mere conclusory statement without more does not counter the fact that Applicants' own disclosure fails to provide a detailed description on how to make the claimed genus of quantum dots – yet, it has not been argued that Applicants' disclosure is not enabling. Moreover, Applicants have not provided evidence showing that, in general, one of ordinary skill in the art would not have known how to make the quantum dot described by Lee.

Accordingly, lacking sufficient evidence and considering Applicants' own description, the Rule 132 Declaration is insufficient to overcome the Lee reference.

Conclusion

No claim is allowed.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Leon Y. Lum whose telephone number is (571) 272-2872. The examiner can normally be reached on Monday to Friday (8:30 am to 5:00 pm).

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark L. Shibuya can be reached on (571) 272-0806. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Leon Y. Lum/
Examiner, Art Unit 1641

/Nelson Yang/
Primary Examiner, Art Unit 1641